THE REGIONAL GEOPHYSICAL SETTING OF GOLD MINERALISATION IN NORTHEAST TASMANIA

by

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STATEMENT

This thesis contains the results of research carried out in the Geology Department, The University of Tasmania between 1989 and 1994. Part of the material presented in Chapter 3 has been published as:

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This thesis contains no material which has been accepted or submitted for the award of any other higher degree or graduate diploma in any tertiary institution and to the best of the author's knowledge and belief, the thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

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ABSTRACT

Gold mineralisation in northeast Tasmania occurs mainly within quartz veins hosted by a thick sequence of folded Ordovician to Devonian turbidites known as the Mathinna Group. This sequence was intruded by post orogenic Devonian granitoids which form the Blue Tier, Scottsdale and Eddystone Batholiths. Gold mineralisation has a close spatial association with the granitoids in some areas but the majority of mineralised sites are remote from granitoid outcrop.

Potential field geophysical methods were applied to assess the spatial relationship between gold mineralisation, regional structure and granitoids. Regional data were used to examine and test tectonic models for the development of the region. Semi-regional and detailed data were used to assess the local structural setting.

Analysis of the regional gravity and magnetic fields indicates that the lower Palaeozoic rocks of eastern Tasmania were thrust to the west over western Tasmanian sequences. The broad magnetic anomaly west of Bridport suggests that Cambrian basic and ultrabasic rocks underlie the Mathinna Group and the granitoids. The gold mineralisation in the Mathinna Group may in part be sourced from these units.

Three mineralised areas within the province were examined in detail. These were selected as representative of a variety of geological settings and several different styles of gold mineralisation.

In the Gladstone area gold mineralisation occurs both close to exposed granitoids and also remote from granitoid outcrop. The magnetic data indicates a strong structural control on the distribution of mineralisation. Many of the mineralised sites north of Gladstone township occur on anticlinal axes and the trend of the quartz veins in this area is parallel to northwest striking faults which are clearly apparent in the magnetics. Gravity data indicates that the maximum thickness of Mathinna Group rocks in the Gladstone area is approximately 2500 metres. There is no clear spatial relationship between the mineralisation and the underlying granitoids. The mineralisation at Gladstone is considered to predate the main phase of granitoid intrusion.

Mineralisation in the Lisle area is closely associated with cupolas of hornblende-biotite granodiorite which intrude the Mathinna Group. Geophysical and geochemical data indicates that these intrusions are separate and distinct from the Diddleum Pluton which forms the western portion of the Scottsdale Batholith. Magnetic and gravity data suggests that there are three geophysically distinct granitoids in the Lisle area. The granodioritic Lisle Pluton has a magnetic and a non-magnetic component but a more felsic intrusive is inferred to underlie the Denison Goldfield. The majority of the gold produced in the Lisle area was alluvial gold recovered from the Lisle valley. Much of this gold shows evidence of remobilisation in the placer. The primary source of the alluvial gold at Lisle remains uncertain but the favoured alternative is that the gold was mainly derived from quartz sulphide veins within the Lisle Pluton and the surrounding contact metamorphosed Mathinna Group rocks.

In the Mathinna region the majority of known gold mineralisation lies in a NNW trending corridor between the Blue Tier and Scottsdale Batholiths. Gold bearing quartz veins in the Mathinna Group strike either parallel or perpendicular to the to the NNW trending regional fold axes. Geophysical data suggest that the thickness of Mathinna Group rocks underlying the gold corridor increases from less than 1000 metres in the Alberton area to approximately 3000 metres in the south near Mangana. There is no consistent spatial relationship between the mineralisation and the underlying granitoids although the subsurface distribution of granodioritic rocks is poorly constrained. The main gold corridor has no magnetic expression and and northwest trending magnetic lineaments mainly reflect lithological variations in the Mathinna Group. Northeast striking lineaments in the Mathinna region mark faults which have a complex history including early dextral and later sinistral movements. The interaction of these faults with pre-existing ENE striking fractures may have been important in the localisation of gold mineralisation during, or immediately prior to, the first phase of granitoid intrusion.

Mineralisation at Golden Ridge is closely associated with an intrusion of biotite granodiorite. Many of the prospects in this area correspond to irregular magnetic anomalies which are inferred to mark zones of magnetite alteration based on assessment of an adjoining anomaly to the west of Golden Ridge. This anomaly, which is one of several broad magnetic features in the Mathinna region, extends beyond the mapped contact aureole.The presence of biotite in association with magnetite in this area indicates temperatures in excess of 400 degrees. These magnetic anomalies may indicate the presence of large

alteration systems possibly related to granodioritic intrusives. The economic potential of these areas should be assessed.

This study indicates that two distinct styles of gold mineralisation are present in northeast Tasmania. The mineralisation at Gladstone and in the main gold corridor from Mangana to Waterhouse is structurally controlled and apparently unrelated to granitoids. At Lisle and Golden Ridge mineralisation is spatially and genetically associated with granodioritic intrusives. No single set of criteria for locating potentially mineralised sites across the entire region has been established but analysis of detailed magnetic data can greatly assist in the definition of zones of structural complexity or areas of alteration.

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